PROPERTIES OF FLY ASH CEMENT SAND BRICK CONTAINING PALM OIL CLINKER AS PARTIAL SAND REPLACEMENT

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Sisa buangan dari industri arang batu dan minyak sawit menyebabkan pencemaran kepada persekitaran. Klinker kelapa sawit (POC) ialah sisa pepejal dari industri kelapa sawit. Pada masa yang sama, pengeluaran simen dari industri simen menyumbang kepada pengeluaran pelbagai gas dan pemanasan global. Disamping itu, memberi kesan kepada kesihatan manusia. Kegiatan perlombongan pasir yang berlebihan juga mengganggu ekosistem seperti pencemaran air yang boleh memberi kesan kepada hidupan akuatik dan hakisan tebing sungai. Kesan klinker kelapa sawit (POC) sebagai penggantian pasir secara separa bagi kekuatan mampatan, kekuatan lenturan dan penyerapan air terhadap bata pasir simen abu telah disiasat. Campuran mengandungi peratusan berbeza klinker kelapa sawit (POC) yang mana 10%, 20%, 30% dan 40% telah digunakan untuk menyediakan spesimen. Semua specimen dilaksanakan kuring sehingga tarikh ujian. Kekuatan mampatan dan ujian kekuatan lenturan dijalankan pada 7 dan 28 hari. Semua ujian dikendalikan mengikut standard ASTM untuk bata. Keputusan ujian menunjukkan bata pasir simen abu mengandungi 30% daripada penggantian klinker kelapa sawit (POC) menghasilkan keputusan terbaik dalam kekuatan mampatan dan kekuatan lenturan. Bagaimanapun, penggunaan penggantian klinker kelapa sawit (POC), menghasilkan peningkatan penyerapan air.

ABSTRACT

The dumping of waste from coal industry and palm oil industry causes pollution to the environment. Palm Oil Clinker (POC) is a solid waste from palm oil industry. At the same time, the production of cement from cement industry produces various of gasses and contributes to the global warming. Besides that, it effects the human health. Excessive sand mining activity also disturbing the ecosystem like water pollution which can give effect to aquatic life and riverbank erosion. In this study, the effect of Palm Oil Clinker (POC) as partial sand replacement on compressive strength, flexural strength and water absorption of fly ash cement sand brick has been investigated. Mix consisting different percentage of Palm Oil Clinker (POC) which is 10%, 20%, 30% and 40% has been used to prepare the specimen. All specimen was water cured until the testing date. Compressive strength and flexural strength test were conducted at 7 and 28 days. All the test was conducted according to ASTM standard for brick. The findings shows that fly ash cement sand brick containing 30% of Palm Oil Clinker (POC) replacement provided the best results in terms of compressive strength and flexural strength. However, utilization of Palm Oil Clinker (POC) shows increase of water absorption.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

POC	Palm Oil Clinker
OPC	Ordinary Portland Cement
POME	Palm Oil Mill Effluent
POC	Palm Oil Clinker
OPT	Oil Palm Trunks
OPF	Oil Palm Fronds
EFB	Empty Fruit Bunches
PPF	Palm Pressed Fibres
OPS	Palm Oil Shells
MF	Mescorf Fibres
PKS	Palm Kernel Shells
CO_2	carbon dioxide
CO	carbon monoxide
SO_2	sulphur dioxide
SO_3	sulphur trioxide
NO_2	nitrogen dioxide
NO	nitric oxide
Pb	Lead
Hg	Mercury
As	Arsenic
C-S-H gel	Calcium Silicate Hydrate gel

CHAPTER 1

INTRODUCTION

1.1 Introduction

The usage of sand and cement has begun since the construction of building and use as main material for construction. Building materials comprise natural substances such as sand, wood, rocks or manufactured materials such as concrete, metal, cement, glass which are used in various applications for construction purposes (Ipsos Business Consulting, 2017). Natural river sand as fine aggregate is the most important resource utilized by the construction industry. The consumption of natural river sand as fine aggregate by the growing population is very high and several countries have encountered shortage of natural fine river sand. The ever increasing population and economic developments impose an exponential rise in demand for natural river sand throughout the world (Arunima & Sreelekshmi, 2013). Sand mining will give some physical impact include reduction of water quality and destabilization of the stream bed and banks. Mining can also disrupt sediment supply and channel form, which can result in a deepening of the channel (Ashraf, Maah, Yusoff, Wajid, & Mahmood, 2011)

Waste materials are a major environmental problem, which is a threat to the environment. It is important to reuse these materials. Waste can be used in the construction industry in two ways which is reusing (reuse components) and recycling (processing waste into raw materials used in the production of building materials) (Dachowski & Kastrzewa, 2016). Malaysia produces many palm oil products and is a major producer of palm oil. In 2015, total oil palm planted area was 5.64 million hectares. Sabah is the largest oil palm planted state with 1.54 million hectares followed by Sarawak with 1.44 million hectares (Azillah, Mohamed, Khalid, Shukri, & Nazreen, 2016). Palm oil industry is well established business in Malaysia which is still developing and growing. In the palm oil mill, after it is being processed, the palm oil shells are used as

burning fuel and as a result, the waste produced by this process is called the clinker (Ahmad & Noor, 2007). Palm oil clinker is a product from palm oil industry produced abundantly can be considered as alternative to natural sand to produce brick as they have similar chemical and physical properties of natural sand. Thus, the present research looks into the effect of using palm oil clinker as partial sand replacement.

1.2 Problem Statement

The natural resources in the world always have higher demand, but in future it will deplete (Thangarjoo, 2014). However, there are some problems that arise related to environmental problems that will be affected through the higher demand of sand and cement. The sand production give some physical disturbance of the sediment while dredging the sand affects the suspended solids and increases the turbidity of the water (Yen & Rohasliney, 2013). The problems that faced is about water pollution because the process to obtaining sand should be through sand mining activity in the river and sometimes it reaches to the excess level. The mining activity pollutes the river which is the main source of the fresh water and also effect the aquatic life and the water quality becomes worse (Muthusamy, et al., 2017). Hence, the production of cement involves the consumption of large quantities of raw materials, energy, and heat (Stajanca & Estokova, 2012). The impact from cement production give some results which is release of a significant amount of solid waste materials and gaseous emissions can caused global climate, dust, contributing to respiratory and pollution health risks.

In addition, excessive waste can cause environmental problems. Palm oil is the most important product from Malaysia and eighty million tonnes of dry solid biomass waste was yielded in 2010 by the oil palm industry in Malaysia and is expected to rise up to 85-110 million tonnes by 2020 (Kanadasan & Razak, 2015). The waste from palm oil will be process as palm oil clinker (POC) producing from fibre combustion and oil palm shell that will be used as partial sand replacement and reduce the sand use. Other than that, the fly ash produced by thermal power plants can cause some environmental risks which is the air pollution caused by direct emissions of toxic gases from the power plants as well as wind-blown ash dust from ash pond. Next, the surface water which the wet system of disposal in most power plants causes discharge of particulate ash directly into the nearby surface water system. It also can cause ground water pollution which the long

storage of ash in pond can cause leaching of toxic metals from ash and contaminate the under laying soil and ultimately the groundwater system.

1.3 Objectives

The objectives of this study as followed:

i. To investigate the effect of Palm Oil Clinker (POC) as partial sand replacement on compressive strength of fly ash cement sand brick.
ii. To investigate the effect of Palm Oil Clinker (POC) as partial sand replacement on flexural strength of fly ash cement sand brick.
iii. To investigate the effect of Palm Oil Clinker (POC) as partial sand replacement on water absorption of fly ash cement sand brick.

1.4 Significance of Study

The use of Palm Oil Clinker (POC) as a partial sand replacement can reduce the use of sand in the construction industry. This study also contributes to controlling sand mining activity that cause water pollution and air pollution that coming from cement industry. The research is expected to contribute to better understanding about the properties of the fly ash cement sand brick containing Palm Oil Clinker (POC) as a partial sand replacement. Other than that, this research can reduce the use of cement and reduce the dumping of Fly Ash at landfill when use Fly Ash as partial cement replacement.

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